ARTHROPODS IN LIVE OAK GALLS IN TEXAS[1]

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ABSTRACT: The relationship between colonies of the ant *Leptothorax obturator* and stem galls on live oaks made by the cynipid *Disholcaspis cinerosa* is discussed. Seven other ant species in the genera *Camponotus, Colobopsis, Crematogaster, Leptothorax, Macromischa, Strumigenys* and *Zacryptocerus* were found in the galls. Sixteen species of arthropods in the orders Araneida, Coleoptera, (other) Hymenoptera, Lepidoptera, Neuroptera and Diplopoda were also present.

In 1903 (p. 251) W.M. Wheeler described *Leptothorax obturator* Wheeler workers, queens and males "from many specimens collected at different times from abandoned *Holcaspis cinerosus* [=*Disholcaspis cinerosa* (Bassett)] galls on live-oaks (*Q. virginia*). The young fertilized queen, on entering the gall to establish her colony, gnaws minute fragments from the ligneous wall, mixes these with some secretion (saliva?) and completely plugs up the round opening through which the *Holcaspis* escaped and she herself has entered. Later when the first batch of tiny workers appear, they perforate the center of the plug with a small opening like a pin-prick, and just large enough for egress and ingress." He also reported it "is also occasionally found nesting in twigs of the wafer-ash (*Ptelea trifoliata*) which have been hollowed out by the tiny carpenter bees (*Ceratina nanula* Ckll. and *C. arizonensis* Ckll.). The relatively large entrance made by the bees at the end of the twig is plugged up by the ants with agglutinated vegetable particles and then perforated with a minute opening in the center." The type locality is Austin, Travis County, Texas.

In 1910 Wheeler figured (Fig. 113, p. 208) the perforated plug in a gall (see also Longino and Wheeler 1987). He also listed six species which he found in galls, in order of increasing frequency: *Leptothorax schaumi* Roger (as *L. fortinodis* Mayr), *L. obturator, Colobopsis etiolata* Wheeler, *Crematogaster laeviuscula* Mayr (as *C. clara* Mayr), *Camponotus decipiens* Emery and *Camponotus sayi* Emery (as *C. rasilis* Wheeler). He described the method used by *Colobopsis etiolata* soldiers in a mature colony to plug the hole with its head. None of these ants build the occluding plug and the pin-prick-sized opening characteristic of *L. obturator,* although one *Colobopsis etiolata* queen with eggs was found in a "sealed gall."

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No further mention was made in the literature of *L. obturator* until Moody and Franke (1982:41 and map 23) recorded this species from oak galls in Real and Uvalde Counties. Wheeler and Wheeler (1985:61) added Bexar County and Longino and Wheeler (1987) added Kerr County, all in Texas.

In Bexar County, Texas, from 29 March 1981 to 15 December 1984 JW collected 999 stem galls made by *D. cinerosa* (Cynipidae) on *Quercus virginiana* (live oak) in one 5-acre plot. Galls were collected from 45 cm to 3 m above ground. Solid unused galls, i.e., galls in which no cynipid larva had developed, accounted for 592 (59%) of the total. Spiny millipedes (*Polyxenus* sp.) lived in 155 (15%); the gall-maker (*Disholcaspis cinerosa*) as larve, pupae or nearly-ready-to-fly imagines were in 50 (5%); spiders in 54 (5%); beetles in 17 (2%). Neuroptera, unidentified small wasps, mites, coleopterous and lepidopterous larvae each accounted for less than 1% (total 3%). (See Table 1.)

Table 1. Some arthropod inhabitants of *Dishcolcaspis cinerosa* galls on *Quercus virginia.*

Order	Family	Genus and Species
Araneida	Salticidae	*Metaphiddipus protervus* (Walskenaer)
	Clubionidae	*Trachelas tranquillus* (Henz)
Coleoptera	Cleridae	*Cymatodera* sp. (larva)
	Bruchidae	*Mimosetes amicus* (Horn)
		M. protractus (Horn)
		Algarobius bottimeri Kingsolver
	Cerambycidae	*Euderces pini* (Oliv.)
	Anobiidae	*Tricorynus castaneus* (Hamilton)
		Tricorynus sp.
Hymenoptera	Cynipidae	*Disholcaspis cinerosa* (Bassett)
	Bethylidae	*Goniozus punctaticeps* (Kieffer)
		Cephalonomia hyalinipennis Ashmead
	Chalcidoidea: larvae and pupae (families not determined)	
Lepidoptera	Gelechiidae	*Coleotechnites* sp.
Neuroptera	Chrysopidae	*Chrysopa rufibarbis* Burm.
		Chrysopa sp.
Diplopoda	Polyxenidae	*Polyxenus* sp.

The spiny milliped *Polyxenus* sp. (Order Diplopoda) numbered from 2 or 3 to more than a dozen in a gall. When they were present there were no other arthropods in that gall. They apparently hollowed the gall until there was only a thin shell left. Spiders seemed to use the galls as safe hiding places for egg-laying nests. According to J.M. Kingsolver (personal correspondence) bruchid beetles [*Mimosestes amicus* (Horn), *M. protractus* (Horn) and *Algarobius bottimeri* Kingsolver] "are apparently over-

wintering as inquilines in the galls. *M. amicus* feeds in seeds of *Prosopis* and several shrubs or trees, *M. protractus* feeds in seeds of *Prosopis* as does *A. bottineri.* Larvae are the feeders in seeds, but the adults feed on pollen and nectar in whatever flower is open at the time." Bruchids hold over, until *Prosopis* pods form, in trash, birds' nests, and galls.

A neuropteron (*Chrysopa* "sp. prob. *rufilabris* Burm.") larva was found feeding on a *D. cinerosa* larva; one *C. rufilabris* was reared out of a cocoon from a gall.

JTL made general collections of arboreal ants, including inhabitants of oak galls, at three sites in Texas: Travis County, near Beecave, 3 November 1982 and Webberville, 2 October 1983; Kerr County, Kerr Wildlife Management Area, 1 September and 8 November 1983.

In our combined collections *Leptothorax obturator* occupied 46% of galls containing ants (see Table 2). They showed the typical plug built by

Table 2. Number and percent of galls inhabited by ants of various species.

SPECIES	Texas Counties			% of galls
	Bexar	Kerr	Travis	
Leptothorax obturator	50	12	4	46
Camponotus caryae discolor	25	4	4	23
Crematogaster laeviuscula	20	0	1	15
Colobopsis etiolata	5	5	2	8
Zacryptocerus texanus	8	0	0	6
Macromischa subditiva	1	0	0	*
Leptothorax sp.	0	0	0	*
Strumigenys louisianae	0	0	1**	*

* = less than 1%
** = 3 workers in same gall with *C. caryae discolor*

the queen and the pin-prick-sized hole opened by the workers. The colony continued to develop in the gall and as it developed the workers did considerable excavation inside the gall. In Bexar County, queens, eggs, larvae and pupae were collected from March to October. On June 16 one gall contained 4 winged females and one male; another contained a single winged female. On the same date an incipient colony in a plugged gall contained a queen and young brood. This suggests that it is possible for *Leptothorax obturator* colonies to spend their entire life cycle in galls. JW found no ants in dead twigs but not for lack of searching.

Leptothorax obturator was found nesting away from oak galls at the Webberville site. No oak galls were found, but three colonies of *L. obturator* were found in the dead twigs of *Bumelia lanuginosa* (ironwood). In general, *L. obturator* appears to be a specialized inhabitant of

Disholcaspis cinerosa galls on live oaks but can nest elsewhere.

Crematogaster laeviuscula, Zacryptocerus texanus (Santschi), *Camponotus caryae discolor* (Buckley) and *Colobopsis etiolata* were frequently observed nesting in dead branches of oaks. When these species were observed nesting in galls, each was often an incipient colony and contained a single queen, brood and a few very small workers. A colony that started in a gall might later add branch nests in adjacent galls or locate a suitable dead branch and move to the new nest site. Thus, galls could be very important sites for establishing colonies in these species.

The unidentified *Leptothorax* was found only once. *Strumigenys louisianae* Roger would be classified as an accidental inhabitant, for it was found only once: 3 workers in a gall with several *Camponotus caryae discolor* workers.

Torossian (1971a, 1971b, 1972) reported on a 9-year study of 1500 cynipid galls collected in Bouconne forest, 22 km west of Toulouse, France. The gall-formers were *Cynips quercus tozae* and *C. kollari* on 3 species of oaks (*Quercus pedunculata, Q. pubescens* and *Q. sessiliflora*). He found that *Leptothorax nylanderi* (Foerster) and *L. rabaudi* Bondroit together occupied 36.97% of galls inhabited by ants, *Colobopsis truncata* (Spinola) 20.24%, and *Dolichoderus guadripunctatus* (Linnaeus) 26.35%. These 3 genera together accounted for 91.55% of ants found in galls. He considered two species, *Crematogaster scutellaris* (Olivier) and *Camponotus fallax* (Nylander), totaling 7.6%, "'hôtes habituels' des galles." The third group, which combined accounted for 0.5%, he classified as accidental inhabitants: *Lasius alienus* (Foerster), *Aphaenogaster subterranea* (Latreille), *Myrmecina graminicola* (Latreille) and *Ponera coarctata* (Latreille).

In 1983 Espadaler and Nieves published a report on ants inhabiting 66 cynipid galls produced by 4 species of gall-makers on 5 species of *Quercus* in Spain. They grouped 7 species of *Leptothorax* and placed them first in their list of ants (in order of decreasing frequency) in the galls, followed by: *Crematogaster scutellaris, Colobopsis truncata, Camponotus fallax, Dolichoderus quadripunctatus* and "otras especies" last.

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